Occasional Paper

Australian Farm Institute

January 1999

Biodiversity - 'Lite' Science

For the owners and managers of farming land in Australia, it is apparent that their ability to manage that land in the future will be increasingly constrained by Government legislation and regulation centred on the stated objective of conserving biodiversity.

While the formal definition of the term 'biodiversity' has some general agreement in scientific circles, this is the only aspect of the subject that appears to have a degree of scientific rigour associated with it.

When it comes to measuring biodiversity, understanding its importance, specifying how biodiversity might be increased or decreased, and most importantly placing a value on biodiversity relative to human activity, it is obvious that the level of science is, at best, rudimentary.

At the southern end of Bronte Beach in Sydney is a twenty metre by twenty metre rockpool that is used by hundreds if not thousands of swimmers every day. Despite a high level of disturbance by humans, anyone with a set of goggles can constantly observe a huge diversity of marine life in the pool, including a variety of fish species, shellfish, see urchins, crabs and all sorts of seaweeds and mosses. To all appearances, the high level of human disturbance has not reduced the biological diversity present in the pool.

In the north-western corner of NSW lies Sturt National Park, covering over 300,000 hectares. This park is visited by relatively few people, and is largely undisturbed. Compared to the neighbouring farmland, however, the park often resembles a moonscape as a result of overgrazing by uncontrolled populations of kangaroos, as well as feral goats.

As a result, the apparent biological diversity present in the park is almost certainly less than that which exists on neighbouring farmland.

These on-ground examples are just two of many that demonstrate the significant weaknesses that exist in theories about biodiversity, its importance, the impact that humans have on it, and how society should go about preserving it.

Despite these deficiencies, Governments and bureaucrats have entered into agreements and policies that are supposedly aimed at preserving biodiversity, and these are now being implemented in State land management policies and planning regulations.

Defining Biodiversity

The National Strategy for the Conservation of Australia's Biological Diversity defines biological diversity or biodiversity as "the variety of all life forms – the different plants, animals and micro-organisms, the genes they contain and the ecosystems of which they form a part."[1] The strategy also explains that that this diversity occurs at three levels:

- genetic diversity which is simply the variety that occurs in the genetic makeup of all living organisms, even within a species
- species diversity which is the variety of different species of organisms that exist
- ecosystem diversity, which is the variety of different habitats and biological processes that exist.

It is evident from this definition that in policies dealing with biodiversity, all living matter and organisms are being considered, as well as the habitats they occupy, and the diversity that exists between these species and organisms. This definition is very broad, encompassing all forms of life on both land and in water.

Measuring Biodiversity

This provides the first interesting challenge in relation to biodiversity, in that, based on generally agreed definitions, it is a concept that can potentially never be measured.

This is because it is recognised that in any ecosystem, the populations of bacteria, fungi and microorganisms are huge, relative to the populations of higher-order plants and any animals that might exist.

For example, it is estimated that in a wheat crop yielding 5 tonnes/ha, the total vegetation prior to harvest is 15 tonnes/ha, and the weight of soil organisms is 21 tonnes.[2]

1 Biological Diversity Advisory Committee. "A National Strategy for the Conservation of Australia's Biodiversity. June 1996.

2 Saunders and Walker. "Biodiversity and agriculture". Reform, Spring 1998.National Farmers Federation.

Scientists recognise the impossibility of a quantitative assessment of biodiversity.

> Traditionally, biodiversity surveys are restricted to the conspicuous organisms such as mammals, birds and flowering plants. But these groups make up only about 15% or less of the species present in most environments. Apart from microbes, it is the invertebrates, especially insects and their relatives, that contribute most to biodiversity."[3]

The author further comments that "The taxonomy of many groups among the Australian biota, especially among invertebrates and microorganisms, is virtually unknown, and their biodiversity is unexplored." The article concludes "Problems of inadequate taxonomic knowledge cannot be quickly solved. The resources required for adequate sampling preclude the monitoring of more than a sample of biota of any but the simplest ecosystems."

Logic suggests that is such situations, a sampling process or easily observed indicator species might be identified to assist with the assessment of changes in biodiversity. "However, the relationship between the presence of such species and biodiversity as a whole is not understood very well, and it may be that other, less conspicuous species are better indicators."[4]

The difficulties associated with measuring biodiversity aren't, however, limited to quantitative measures. It is apparent that there is 'good' and 'bad' biodiversity. For example, replacement of native grasses with improved pastures and legume species dramatically increases the volume of vegetation per hectare, and the volume of soil flora and fauna, but also changes the mix of species present in that environment. The net impact of the action may be an increase in measures of biodiversity, but with changes in the species present.

Reinforcing this at a macro level, scientists believe that as a result of farming activities, populations of large kangaroos, and birds such as galahs, corellas and cockatoos have increased, and honeyeaters and crested pigeons have expanded their ranges.[5] Despite this, it is apparent environmentalists consider that such changes result in 'bad' rather than 'good' biodiversity.

A further complication in measuring biodiversity is that it is not a factor that is constant in an undisturbed environment over a given period of time. At different times, various species go through 'boom and bust' stages for purely natural reasons. Cycles of drought, flood, fire and climate variation, plus genetic change can have significant impacts on different species, which then have flow-on effects on others. "The process of evolution means the pool of living diversity is dynamic: it increases when new genetic variation is produced, a new species is created or a novel ecosystem is formed; it decreases when the genetic variation within a species decreases, a species becomes extinct, or an ecosystem complex is lost."[6]

As a result, even if a suitable quantitative measure of biodiversity was available, it is the relative rate of long-term change, rather than short-term variation or aberrations that is significant.

Many environmental lobbyists seem to conveniently ignore the dynamic nature of ecosystems when seeking to highlight the latest 'catastrophic' change in biodiversity. In fact, some Australian publications on the subject appear to adopt 1788 as a reference point, on the assumption that this was an environmental nirvana where all living things were in equilibrium, and never changed.

This view has been comprehensively contradicted in various articles, most recently by Miller, who provided evidence of the disappearance of more than 85% of Australia's large animals 50,000 years ago.[7]

The conclusion is that biodiversity is something that cannot easily be measured, and even if it could be, short-term changes in biodiversity measurements are of questionable significance in making an assessment of the impact of various human activities on an ecosystem.

But rather than acting quickly to address the obvious knowledge deficiencies and contradictions inherent in biodiversity theories, the so-called 'precautionary principle' makes a virtue of ignorance, and removes much of the incentive to address the scientific deficiencies that exist.

The Precautionary Principle

In recognition of the uncertain nature of any qualitative or quantitative measures of biodiversity, a concept termed the 'precautionary' principle has been implemented in biodiversity agreements and policies.

The preamble of the United Nations Convention on Biological Diversity notes:

> Where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimise such a threat.[8]

This concept is also incorporated as a principle in Australia's national strategy for biodiversity conservation. It is also incorporated in the 1992 Intergovernmental Agreement on the Environment, which was signed by the Commonwealth, State and Territory, and Local Government representatives. This agreement explains that in applying the principle:

> Public and private decisions should be guided by : (1) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and (2) an assessment of the risk-weighted consequences of various options.[9]

This principle has significant implications for a number of reasons.

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3 Creagh and Schmedding. "What can we learn from insects ?". Ecos. Summer 1993/94.

4 Lee, K. Op cit

5 National strategy for conservation of Australia's Biological Diversity. Op cit

6 Biodiversity Unit, DEST. "Biodiversity and its value" Biodiversity Series, Paper No. 1. 1993

7 Miller et al. "Pleistocene Extinction of Genyornis newtoni: Human impact on Australian megafauna." Science (283) January 1999

8 United Nations. Convention on Biological Diversity. June 1992.

9 Commonwealth of Australia. "Intergovernmental Agreement on the Environment." 1992

Firstly, as always in relation to policies and agreements, the problem of degrees of interpretation arises. The principle uses the words "where there is a threat of significant reduction or loss of biological diversity", implying that available evidence will already point to such an outcome if the proposed activity is allowed to proceed.

However it seems that the question of whether or not the potential impact on biodiversity will be a significant loss is not incorporated into policy. This is hardly surprising, given that scientists readily recognise that they cannot reliably measure most aspects of biodiversity, let alone make some value-judgement about whether a potential change is significant. Policy as it stands appears to take the position that any potential change in biodiversity arising from a proposal is sufficiently significant to negate any benefits that might arise from the development.

A further reason the precautionary principle is significant relates to public policy processes. Effectively, the principle provides an escape clause for Governments and bureaucrats when they face a lack of information. Rather than having to provide technical information to justify decisions restricting farm development, the precautionary principle provides a universal excuse to refuse any proposal, without necessarily providing a reason.

It also removes much of the pressure on Governments to provide serious resources to overcome the information vacuum, despite this being a key component of both national and international biodiversity agreements.

The principle also represents a trojan horse for zero development conservationists – those elements of the environment movement who see any development as bad and are simply looking for any excuse to halt progress.

It also enables an abrogation of the traditional role of the scientific community, in that rather than actively seeking new technologies that may solve some of the problems associated with development, environmental science is given an excuse to do nothing. It is interesting to speculate whether man would have reached the moon, or if human population would have outstripped world food supplies, if the precautionary principle had been adopted fifty years ago.

The Value of Biodiversity to Farmers.

Perhaps in recognition of the deficiencies in scientific theories associated with biodiversity, many publications on the subject go to great lengths to explain that, irrespective of the science, the conservation of biodiversity results in significant benefits to farmers. These benefits are grouped into three broad categories, which are:

- the provision of ecosystem services
- the provision of biological resources
- social benefits to the community.

Ecosystem services are defined as the normal biological processes that occur in nature, and that farmers utilise in order to produce food and fibre for the world. These processes include the activities of vegetation in water cycles, the stabilisation of soil and the prevention of erosion. Other services that various components of biodiversity carry out include processes associated with soil formation, the breakdown and decomposition of dead plant material, and the mineralisation and de-mineralisation of various chemicals essential or harmful to plant and animal growth.

These are in fact the processes that farmers have been working with, modifying and managing for centuries – even before the term biodiversity was invented.

In Australia, the utilisation of legumes to increase soil nitrogen, superphosphate to improve soil fertility, and the selective breeding and introduction of both native and introduced plant species has enhanced the productive capacity of the land many times over.

These changes have not always been without negative impacts, and the problem of soil salinity is evidence of the need to reconsider pasture species and the role of trees in lowering water tables. However, there is little that is unique about the ability of the original native species and organisms to carry out these functions. Appropriate management strategies coupled with a better plant species mix have been successfully utilised to overcome these problems, while still maintaining high levels of productivity.

The latter is not possible under a regime that requires the preservation of all components of the original ecosystem.

In conclusion, while farmers undoubtedly benefit from ecological services, these are not necessarily solely available from the original species in an ecosystem, and are not necessarily as effective as the services provided by introduced species.

Biological resources are often cited as a second important reason that farmers should be prepared to conserve biodiversity. World food production is based largely on three or four carbohydrate crops.[10] This narrow genetic base is augmented by genes from wild species when it is desired to improve productivity and disease resistance. Additionally, wild plant, animal and microorganisms are a major source of products that are utilised in human medicine. Wood is an essential component of housing, and the unique qualities of many native trees have either added to timber stocks, or been used to genetically improve existing commercial species.

It is argued that destruction of biodiversity may result in the extinction of a potentially valuable biological resource.

There is no question that mankind continues to benefit from scientific advances based on the availability of a diverse range of wild species, and that this is a strong argument for the conservation of biodiversity. Ultimately, however, two factors need to be considered.

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[10] Biodiversity Unit. Op. Cit.

The first is that individual private landholders are unlikely to ever benefit directly from such discoveries, and they therefore have no direct personal incentive to ensure that every single species present on that land is preserved. Even if a major farming advance that would benefit all farmers was made as a result of investigations carried out on a species identified on a farm, the owner of that farm would invariably have to pay to utilise that technology.

The second factor to consider is that the chance of a major discovery being made from a species identified on an individual farm is minuscule. Consequently, there is no economic sense in a farmer locking up land on the chance that one of the species present will be unique to that land, and will also have some unique biological characteristic that can be utilised commercially. This is particularly so in view of the fact that scientists themselves admit that all these species will not be identified, let alone investigated, in the foreseeable future.

While the 'biological resources' arguments may be correct, they are generally of no value to an individual landholder.

Social benefits that are considered to arise from the conservation of biodiversity include the role of relatively undisturbed areas as 'living laboratories' to study biological processes, and the use of such areas for recreation. Biodiversity advocates also advance the cultural relationship between Australian society and the 'bush' as a significant reason for biodiversity preservation. "The aesthetic values of our natural ecosystems and landscapes contribute to the emotional and spiritual well-being of a highly urbanised population" is how the Commonwealth Department of the Environment has described this aspect of the benefits of biodiversity conservation.[11]

Needless to say, such arguments are not readily accepted by individual landholders faced with income loss as a result of restrictions on their land use, particularly in areas that are rarely, if ever, visited by urban people!

Conclusions

The gaping holes evident in the science associated with biodiversity cannot be papered over by the highly questionable benefits claimed to arise for individual farmers as a result of biodiversity conservation. It is apparent that any benefits are largely of a public nature, especially given that farmers are generally considering the development of relatively small portions of the total land that they manage.

Ultimately, the failure to measure and place a value on biodiversity is creating a major policy dilemma, under which the costs of 'community' benefits are being imposed on a small group of individuals. If the desired outcome is long-term biodiversity conservation, it is clear this will not occur until this dilemma is resolved.

[11] Biodiversity Unit. Op cit

This paper originally appeared as an edition of the Primary Report published by NSW Farmers' Association. Re-published in 2004 by the Australian Farm Institute.